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ABSTRACT

Two studies were performed to determine the process used by young children to figure out the meaning of a new word. It was hypothesized that the children would use one of two strategies: (1) ignore the word and wait for more information, or learn only what is unambiguous about it, or (2) make a reasonable but uncertain guess, quickly setting up relatively complete but sometimes faulty semantic representations for new words. In one study, 3-year-olds were exposed to the word "ecru" using a beige cup with an unusual shape in one of three conditions: contrastive information given, a label only given, and a control condition in which the word "ecru" was not given at all. The children were given a cup identification task and a hyponym task. Results indicated that some children used the latter, error-prone strategy. In a second study, 4- to 8-year-olds and adults were exposed to the same experimental design but heard "ecru" contrasted with "red." Similar results were found: some children and adults use the more error-prone strategy for word learning, and a general bias exists favoring shape and category labels over color. Questions concerning a possible hierarchy of attributes considered by word learners and concerning the situations in which learners need and use linguistic contrast are discussed, and further research is recommended. (MSE)

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Children's Word-Learning Strategies

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When children try to figure out the meaning of a new word, they face a major problem of induction. For any finite amount of information about the new word's meaning, there will be an infinitely large number of possible hypotheses that are consistent with it. The information is therefore never sufficient to rule out all of the incorrect hypotheses (cf. Peirce, 1957; Quine, 1960). Faced with this problem, children have several options. They can use a strategy that minimizes errors. That is, they can either ignore the word and wait for more information, or learn only what is unambiguous about the word. Alternatively, they can use a liberal strategy to make a reasonable but uncertain guess. This latter strategy allows children to set up quickly relatively complete--although at times faulty--semantic representations for new words.

Which of these strategies children use has important implications for the word-learning mechanism. While we know that children overextend and underextend word meanings (see, for instance, Clark, 1973; Bloom, 1973), it remains an open question whether children use mostly an error-minimizing strategy or a liberal strategy in word learning. If children use primarily a strategy that minimizes errors, their representation of word meanings should contain mostly correct information. If children use primarily a liberal strategy, they may, in theory, make numerous mistakes. The word-learning mechanism, then, must have effective means of correcting mistaken hypotheses.

In order to examine children's word-learning strategies, I taught some children the color word *ecru*. I gave them different amounts of information about this word to find out how much information they needed before they would hypothesize about the meaning of *ecru*. Because the sample sizes of my studies are quite small, they should be treated as pilot studies.

STUDY 1

Method

In this study, I taught some 3-year-olds *ecru* using a beige cup that had an unusual shape. It was a cup for draining silverware and had an irregular pentagonal cross-section and holes at the bottom. I used this cup to teach children the word *ecru* because the children were unlikely to have a label for either the color or the shape of this cup. Color, then, would not be the only likely candidate for the meaning of the new word *ecru*. Twenty-four 3-year-olds (3;01 - 3;11, mean age = 3;7) participated in the study. The children were randomly assigned to one of three conditions, with the constraint that the conditions were balanced for age and sex.

(1) In the **Contrastive Information Condition**, I contrasted *ecru* with another color word *red* to give children information about the semantic domain of *ecru*. These children saw an odd-shaped beige cup and a cylindrical red cup, and were asked, "Can you bring me the ecru cup? Not the red cup, the ecru cup." I used this procedure because, according to Carey and Bartlett (1978), 3-year-olds seem to be quite sensitive to this kind of linguistic contrast, and seem to use such

information to figure out the meaning of an unfamiliar color word. More recently, Heibeck and Markman (1985) have replicated Carey and Bartlett's findings using a number of color terms, shape terms, and texture terms, with two-and-a-half year olds as well as 3-year-olds. I therefore thought that contrasting *ecru* with *red* would be sufficient to lead children to think that *ecru* was a color word, whether they used a relatively error-free or relatively error-prone strategy.

(2) In the **Label Only Condition**, children saw only the odd-shaped beige cup, and heard, "Can you bring me the ecru cup? That's right, the ecru cup." From an adult perspective at least, there was more than one likely candidate for the meaning of *ecru*. If children used a strategy that minimizes errors, when asked to guess the meaning of *ecru*, they might say, "I don't know," and refuse to make a guess. Alternatively, they might use *ecru* to refer to only the odd-shaped beige cup, keeping in mind at the same time that *ecru* could refer to other objects. In contrast, if they used a liberal and error-prone strategy, some of them might think that *ecru* referred to the color of "the ecru cup;" others might think that *ecru* referred to the shape, material, or texture of "the ecru cup," or to a subtype of cups.

(3) In the **Control Condition**, *ecru* was not introduced to the children. The predictions were as follows: If they used a strategy that minimized errors, when asked what *ecru* meant, they could say they did not know and refuse to make a guess. If they used a liberal and error-prone strategy, some of them might think that *ecru* referred to the color of "the ecru cup;" others might think that *ecru* referred to the shape, material, or texture of "the ecru cup," or to a subtype of cups.

Two days after the introducing events, I tested the children individually to find out what they had learned about *ecru*. Because some children in Carey and Bartlett's (1978) study seemed to remember the new word even seven to ten days after the introducing event, I thought a two-day delay procedure should avoid floor performance. And I thought that such a procedure would also avoid ceiling performance, which might occur with immediate testing. Here is a list of the tests: (1) Cup Naming; (2) Color Naming; (3) Cup Identification; (4) Hyponym Test; (5) Color comprehension.

I first showed children the odd-shaped beige cup, and asked, "What is this?" Then I asked them to name several color chips, including a beige chip.

In the cup identification task, I showed the original odd-shaped beige cup, two cups of the same shape but different colors, and a mug of the same beige color but a different shape. I asked children, "Do you see an ecru cup here?" If they chose one, then I asked, "Any more?" In the hyponym task, I showed children a red ring, and said, "This is not ecru because it is...." The rationale for this test is that if children thought *ecru* was a color word, they might say, "This is not ecru because it is red." Finally, I showed children ten rings of different colors, and asked them, "Do you see an ecru ring here?" If they chose one, I then asked, "Any more?"

The order of the cup identification task and the hyponym task was randomized and counterbalanced across children. The order of the five tests was otherwise fixed for two reasons. The test session began with the naming tasks so as to limit the number of times children heard the word *ecru* before these naming tests. The color comprehension test came last so as not to highlight color as a possible semantic domain for the meaning of *ecru* before the cup identification and hyponym

tasks.

Results and Discussion

First, none of the children called the beige cup or the beige color chip *ecru*. It seems that, with a 2-day delay, these naming tasks were too difficult for the 3-year-olds.

For the hyponym test, only one child said, "This is not ecru because it is red." And that child was in the control condition. The rest of the children said, "This is not ecru because it is a circle;' or "...because it is round;" or "...because it is a bracelet." That is, almost all of the children contrasted *ecru* with a shape term, or an object category label. They did not seem to think that *ecru* was a color term.

In the cup identification test, none of the children identified "the ecru cup(s)" on the basis of color. Eight children chose the cups on the basis of shape. I will elaborate on these findings presently.

In the color comprehension test, when asked if they saw an ecru ring, none of the children in the control group picked the beige ring. Instead, they picked out the brown, grey, pink, or purple ring. The beige ring, then, did not seem to be perceptually more salient than other color rings. In the Label Only condition, one child picked the beige ring. In the Contrastive Information condition, three children picked the beige ring. Three children insisted that they did not see any ecru rings. These three children had earlier identified the ecru cup(s) on the basis of shape/subtype. Their denial that any of the rings were ecru was consistent with the interpretation that *ecru* referred to the shape/subtype of the cup.

Now let us return to take a closer look at the Cup Identification data.

Table 1: Cup Identification Data from 3-year-olds

Response Pattern	Contrastive Information	Label Only	Control
Shape/subtype (3 odd-shaped cups)	6	2	0
Mug only	0	2	3
All 4 cups	0	4	0
Green/brown cup	1	0	4
No ecru cup	1	0	1
Total	8	8	8

When children were asked to identify "the ecru cup(s)," six of the eight children who heard *ecru* contrasted with *red* did so on the basis of shape/subtype. That is, they chose only the three odd-shaped cups. Two children in the Label Only condition and none in the control condition did so. It seems that when children made a guess, they tended to think that *ecru* referred to the shape/subtype of cups.

Contrasting *ecru* with *red* did not seem to help the 3-year-olds to map *ecru* onto the semantic domain of color words. Instead, it seemed to encourage children to learn something about *ecru* and to make a guess about its meaning.

Also, two important response patterns are missing here. First, none of the children identified "the ecru cup(s)" on the basis of color. Second, none of the children seemed to use the error-minimizing strategy of applying *ecru* only to the original odd-shaped beige cup.

These findings suggest that some children use a rather liberal and relatively error-prone strategy to figure out the meaning of a new word. But because the sample size of this study was rather small, I wanted to replicate these findings.

STUDY 2

This study was an attempt to replicate Study 1 across a broader age range. Nineteen children, ranging from four to eight years of age, and nine adults participated in the study. The procedure and research design were similar to that of Study 1 for the children. The adults, however, all heard *ecru* contrasted with *red*, and were tested immediately after the introducing event.

Results and Discussion

Like the 3-year-olds in Study 1, when the 4- to 8-year-olds made a guess, they tended to think that *ecru* referred to the shape/subtype of cups--even when they heard *ecru* contrasted with *red*. (See Table 2 for their cup identification data.)

Table 2: Cup Identification Data from 4- to 8-year-olds

Response Pattern	Contrastive Information	Label Only	Control
Shape/subtype (3 odd-shaped cups)	5	4	2
Mug only	2	2	0
All 4 cups	0	1	0
No ecru cup	0	0	1
"Don't know what ecru means."	0	0	2
Total	7	7	5

Although the nine adults had heard *ecru* contrasted with *red*, and were tested immediately after the introducing event, all but one of them used *ecru* to refer to the shape/subtype of "the ecru cup" at the beginning of the test session. Three of them still did so at the end of the test session.

CONCLUDING REMARKS

In both studies, some adults as well as children seemed to use a rather liberal strategy to figure out the meaning of a new word. When they made a guess, they tended to think that *ecru* referred to the shape/subtype of cups. This bias favoring shape/subtype over color might indeed be quite robust because a similar bias was found in a study of word learning done by Julie Dockrell (1981). Dockrell taught children a nonsense word, *gombe*, using three blocks of different colors and different shapes. She said to the children, "Pass me the *gombe* block, not the red one or the green one, but the *gombe* one." Four of the eight children in her study seemed to think that *gombe* referred to the shape of the block, although *gombe* was contrasted with *red* and *green*. (See also Dockrell & Campbell, in press.)

This bias favoring shape/subtype is consistent with the over-extension data on early word meanings. For instance, in surveying diaries of 1- and 2-year-olds' speech, Eve Clark (1973) has found that about 90% of the cases of over-extension were based on shape. The bias favoring shape/subtype in word learning, then, might be quite prevalent across ages. It seems to start from age one or two years, and endures even for adults. This bias may also reflect the special status of sortal terms, or category labels, for objects. When someone points to an object and supplies an unfamiliar label, children often assume that the word is a category label for the object (Macnamara, 1982; Markman & Hutchinson, 1984; Soja, Carey, & Spelke, 1985). In my studies, the children might have interpreted *ecru* as the category label for a subtype of cups rather than as a shape term.

Now what can be concluded about children's word-learning strategies? My findings, together with Dockrell's, suggest that children sometimes use a rather liberal word-learning strategy. They sometimes incorrectly infer that a color word refers to the shape/subtype of an object although they have heard the word contrasted with another color word. Beyond that, I cannot say much about the issue of liberal versus error-minimizing strategies because of the strong bias favoring shape/subtype over color. We do not know, for instance, whether or not the liberal strategy found in my studies represents a general liberal strategy in word learning. It may be that people normally use a strategy that minimizes errors, and my subjects used a liberal strategy to make a guess only because the bias favoring shape/subtype made shape/subtype seem an extremely plausible meaning for *ecru*.

This bias favoring shape/subtype over color also raises a question about learning words that refer to attributes of objects, namely, what are the factors that underlie a bias favoring one hypothesis over other competing hypotheses? Take the bias favoring shape/subtype over color in my studies as an example. This bias, as discussed earlier, could be due to the special status of category labels--including subtype labels--for objects. On the other hand, it could also be due to something about the shape and the color of "the ecru cup." For instance, perhaps people have a hypothesis hierarchy favoring shape over color when they learn words that refer to attributes of objects. That is, although a new word said of an object (e.g., *ecru* as in "the ecru cup") can refer to any of the numerous attributes of the object, people may entertain certain hypothesis before other hypotheses. They may have a hierarchy of hypotheses in their word-learning mechanism, and entertain first the

hypothesis at the top of the hierarchy (e.g., shape). If they already have a word referring to this particular attribute of the object, they may work their way down the hypothesis hierarchy to consider the next possible meaning for the new word (e.g., in the semantic domain of material, texture, or color), and so on. However, the bias favoring shape over color could also be due to the salient shape of the odd-shaped cup. That is, perhaps the odd shape of the cup was much more salient than its nondescript color, beige, so shape seemed a more likely candidate for the meaning of *ecru* than color did. One way to address the issue of hypothesis hierarchy versus salience is to examine these kinds of biases across several perceptual dimensions such as shape, color, texture, material, and size, with stimulus materials varying systematically in salience along these dimensions. Such a study may also tell us something about the issue of liberal versus error-minimizing strategies. For instance, if one finds that children are willing to make uncertain guesses about a new word's meaning across a variety of situations, one can be more confident in concluding that children use a liberal strategy in word learning.

Another important question about word learning remains open, namely, in what situations will children need and use linguistic contrast, such as "the ecru one, not the red one," to infer the meaning of a new word? At first, Carey and Bartlett's (1978) and Heibeck and Markman's (1985) data on fast-mapping seem to suggest that children use such linguistic contrast in word learning. A closer look at their procedures raises doubt about this because the linguistic contrast and the non-linguistic information in their studies converged to favor the same hypothesis about the new word's meaning.

Consider Carey and Bartlett's (1978) procedure. They taught children the word *chromium* for the color olive-green. The children saw two trays that differed only in color, and heard, "Bring me the chromium tray. Not the red one, the chromium one." There were several obvious candidates for the meaning of *chromium*, such as color, shape, material, size, and texture. But because the two trays differed only in color, and one tray was "chromium" while the other was not, *chromium* could only refer to the color of "the chromium tray." In other words, the non-linguistic information together with the information that the olive-green tray was chromium and the other tray was not chromium would be sufficient to lead children to think that *chromium* was a color term, and to rule out all competing hypotheses. And the children did not need to think about the semantic domain of the contrasting word *red* to figure out what *chromium* referred to. If my analysis is correct, an introducing event such as "Bring me the chromium tray. Not that one, the chromium one." should be just as effective as "Not the red one, the chromium one."

While we do not know yet whether children in Carey and Bartlett's (1978) and Heibeck and Markman's (1985) studies used linguistic contrast *per se* to infer a new word's meaning, the children in my studies clearly did not. Recall that some children in my studies heard *ecru* contrasted with *red* and still thought that *ecru* referred to the shape/subtype of cups. Perhaps in my studies, the shape/subtype of the odd-shaped beige cup was so salient that color became an unlikely candidate for the meaning of *ecru*, and the linguistic contrast between *ecru* and *red* was simply ignored.

In other words, when the linguistic and non-linguistic information converges,

as in Carey and Bartlett's (1978) procedure, we cannot tell whether children need and use the linguistic contrast to infer a new word's meaning until we run a proper control, such as "Bring me the chromium tray. Not that one, the chromium one," that I suggested earlier. And when the linguistic and non-linguistic information points to radically different hypotheses, as in my studies where linguistic contrast points to color while the salient shape points to shape, the non-linguistic information may override the linguistic contrast. But it is still possible that children may need and use linguistic contrast in situations between these two extremes.

Linguistic contrast may also be useful when it is the only information available about the meaning of a new word. For instance, if children hear, "...it's not red; it's not green; it's ecru," without seeing the object being referred to, they may infer that *ecru* is a color term. In addition, linguistic contrast may be useful when several possible meanings are equally plausible. For instance, if a new word refers to an object that has a very salient shape, color, material, texture, and so on, the linguistic contrastive information may make a certain hypothesis more attractive by singling out that dimension.

To sum up, my research leaves us with many questions about children's word-learning strategies. It, nonetheless, suggests that children sometimes use a rather liberal strategy to infer the meaning of new word. But we do not know yet whether these findings will hold up with different stimulus materials and across different semantic domains. In short, it remains to be seen how prevalent this liberal word-learning strategy may be.

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